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RARE PLANTS IN COASTAL HEATHLANDS: OBSERVATIONS ON *COREMA CONRADII* (EMPETRACEAE) AND *HELIANTHEMUM DUMOSUM* (CISTACEAE)

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ABSTRACT

The effects of prescribed burning experiments on two rare coastal heathland species are described. Fire killed adult *Corema conradii* Torr., but resulted in abundant seedling regeneration. Ants may be important vectors in the dispersal of *Corema* fruits. Following a spring burn, both cover and flowering of *Helianthemum dumosum* (Bickn.) Fern. increased. Seedlings of this species also were more common, especially where cover of *Cladonia* lichens was reduced. Occasional fire may be necessary to maintain healthy, reproductive populations of these species.

Key Words: *Corema conradii*, *Helianthemum dumosum*, heathlands, fire ecology, myrmecochory, Nantucket

Coastal heathlands are found from New Jersey to the Canadian maritime provinces. This vegetation type is dominated by low shrubs primarily in the Ericaceae, but also includes heath-like members of the Empetraceae, Myricaceae, and Cistaceae (Harshberger, 1914; Tiffney and Eveleigh, 1985). However, because of increasing losses resulting from plant succession and real estate development, coastal heathlands are now considered threatened throughout their range. As part of the Massachusetts Audubon Society's long-term studies on the origin, dynamics, and management of coastal heathlands in New England (Dunwiddie and Caljouw, 1989; Dunwiddie, 1989) prescribed burns have been carried out since 1983 to examine the effects of fire on this community. I describe here observations on two heathland species of "special concern" (as defined by the Massachusetts Natural Heritage Program, Sorrie, 1987) made in connection with these studies on Nantucket Island.

Corema conradii Torr., Broom Crowberry, is a low-growing, dioecious, evergreen shrub, seldom exceeding 30 cm in height. Both male and female flowers are inconspicuous, and are apparently wind pollinated. On Nantucket, the species is usually the first of the native taxa to flower, reaching anthesis by mid- to late

March. I have recorded flowering as early as January; most plants have finished blooming by May.

The spherical fruits ripen by July, average 1 mm in diameter, and have been described as dry, juiceless drupes with 3 (4–5) nutlets (Gray, 1848; Fernald, 1950). However, on many specimens, I observed that the basal portion of these fruits develops into a white, fleshy structure that occasionally exceeds the size of the remainder of the fruit. I can find no description in the literature of this structure, which remains fleshy for several weeks, and appears to function much like an elaiosome on a seed. Ants in the complex *Aphaenogaster rudis* were observed collecting these fruits and returning with them to their burrows. Fruits with the fleshy basal portion eaten off were carried out of the burrows, and dropped in mounds in front of the burrows; one such mound had approximately 3700 fruits in it. There was no evidence of damage to the nutlets within the fruits, and studies are continuing to determine the role of myrmecochory in the regeneration of Broom Crowberry.

On Nantucket, *Corema conradii* occasionally occurs in dense patches covering several hectares. These patches are reminiscent of European *Calluna* and *Erica* heathlands, where senescent individuals gradually die out in the center, leaving bare patches in which lichens and other species may appear. Ages of the oldest individuals of *Corema,* determined by counting annual branching nodes, exceeded 40 years. Concerns regarding the virtual absence of *Corema* seedlings in these aged patches led to the experiment described here, in which a 20 × 20 m square plot within one such patch was burned on 12 April, 1987. The occurrence of *C. conradii* in areas with high fire frequencies, such as the pine barren plains of New Jersey (Good et al., 1979), suggested that it might be well adapted to fire, although Stone (1911) reported its extermination by severe fire.

A total of thirteen vascular plants was recorded within the plot prior to burning, but data from thirty vegetation quadrats (20 × 100 cm) emphasized the extremely low diversity of this vegetation. Only three species had cover values that exceeded 1%: *Corema* (61%), *Arctostaphylos uva-ursi* (L.) Sprengel (21%), and *Cladonia* spp. (43%). Both headfires and backfires were used to burn the plot, although no differences were detected in terms of impacts on plants or soil humus. Virtually all above-ground portions of

plants in the plot (except *Quercus ilicifolia* Wang. and *Pinus rigida* Miller) were consumed by the burn, but the layer of humus 2–4 cm thick, comprised primarily of *Corema* leaves, remained moist and largely undisturbed.

All of the *Corema* was killed by the fire, and no seedlings were observed during the first summer, despite an abundant seed bank visible in and on the soil. Other species, all perennial plants present within the plot prior to the burn, were observed resprouting, although no seedlings were noted in July. At the end of the first year (1987), *Arctostaphylos* had returned to half (11%) of its original cover.

In June of 1988, seedlings of several species were noted, primarily *Corema, Arctostaphylos,* and *Hudsonia ericoides* L.; counts in thirty-eight 0.25 m^2 quadrats yielded a total of 383, 42, and 22 individuals, respectively. The *Corema* seedlings were so large (up to 1 cm tall) that I suspected they had germinated the previous fall. Subsequent observations in October, 1988, revealed a new crop of germinating seedlings, suggesting that the original crop also may have sprouted in the fall following the burn. Studies are continuing to determine growth rates, recruitment, and mortality in this new *Corema* population. Initial observations indicate that individuals may be growing more vigorously when associated with an *Arctostaphylos* nurse plant. However, *Arctostaphylos* had reached 33% cover at the end of 1988, exceeding its pre-burn levels, and it is likely to dominate this area for some time.

Helianthemum dumosum (Bickn.) Fern., Bushy Rockrose, is endemic to southern New England, and occurs frequently on Nantucket in the more diverse and herbaceous-rich coastal heathlands, sometimes referred to as sandplain grasslands. This perennial herb, up to 25 cm tall, has perfect flowers with bright yellow petals in early summer, but produces only cleistogamous flowers later in the season.

In order to determine the effects of fire on *Helianthemum,* a two-hectare burn was conducted on April 1, 1988 that included a large population of bushy rockrose. Measurements were made to determine changes in three parameters thought to be potentially affected by burning: plant cover, flowering, and seedling establishment. These variables were measured in thirty 0.25 m^2 quadrats arranged along three 10 m long transects in the area to be burned, and on two other transects in a nearby control area. Each quadrat was subdivided into one hundred 5 cm squares, and data were collected on the presence of seedlings, flowers, and adult

Table 1. Data on *Helianthemum* from burned and control plots before (1987) and after (1988) treatment. All data are reported as average number of occurrences per 0.25 m^2 quadrat (see text).

		Adults	Flowers	Seedlings
Treatment:	1987	34.3	6.7	1.5
	1988	47.2	23.0	3.2
Control:	1987	15.3	3.8	2.3
	1988	15.7	4.4	2.4

Helianthemum plants in each square. The data are therefore constrained to values from 0–100. This method was adopted because the bushy growth form and dense vegetation made it difficult to distinguish individual plants. Data were gathered in June, 1987, and again in June, 1988, following the burn, and are summarized in Table 1.

Changes in the vigor of adult *Helianthemum* plants resulting from burning were assessed by examining changes in the number of squares containing adult plants in each quadrat. This value (Table 1) increased in 1988 by about 40% over the 1987 values in the burned plot, whereas the control plot remained unchanged. Flowering showed an even greater change, increasing by nearly a factor of four after burning. Seedlings were also twice as abundant as before.

Aspects of *Helianthemum dumosum* seedling establishment in other burned areas on Nantucket are also worth noting. At one site, lichens (*Cladonia* spp.) averaged 20–40% cover, in many places blanketing essentially all of the ground surface not occupied by bunch grasses and other vascular plants. *Helianthemum* seedlings were extremely rare in these areas prior to burning. After a March burn, however, lichen cover dropped to <2%, and numerous *Helianthemum* seedlings sprouted in the bare openings. Because the lichens are so slow to re-establish, it appears likely that many of these seedlings will survive. These results and observations suggest that both lichens and dense litter cover may inhibit seedling establishment of *Helianthemum*.

The studies described here indicate an important potential role of fire in the population dynamics of two coastal heathland species. Although adult *Corema* plants may be killed by fire, significant reproduction may only occur following such events. Maintenance of viable populations of individuals of different ages may require a management regime spanning many decades, in which small patches within each population are occasionally burned, but large

areas are left alone. Growth of adult *Helianthemum* plants appears to be enhanced by fire, which also encourages its regeneration. Additional studies are needed to determine the effects of repeated fires on growth and mortality of both these species.

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